Low-Fidelity simulation models

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Low-fidelity Simulation Models

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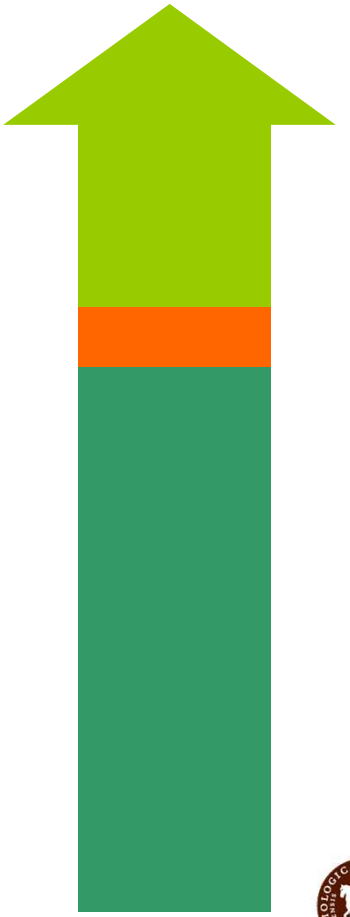
The Basic Surgical Skills course - Context

Veterinary curriculum in DK:

- Bachelor - 3 years
- Master – 2½ years

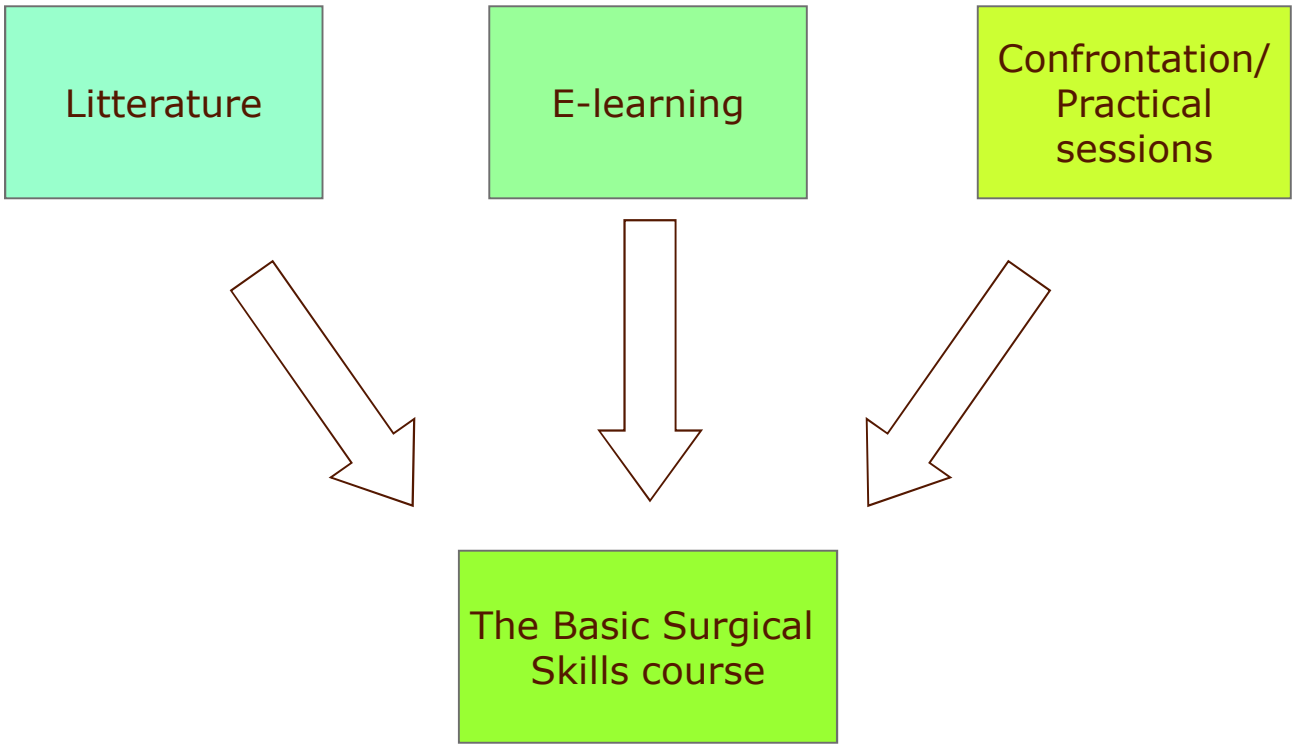
The Basic Surgical Skills course

- First year Master course (4th year students)
- Eight day course
- 36 students attend each course



The Basic Surgical Skills course

- a Blended Learning case



The Basic Surgical Skills course

Confrontational part

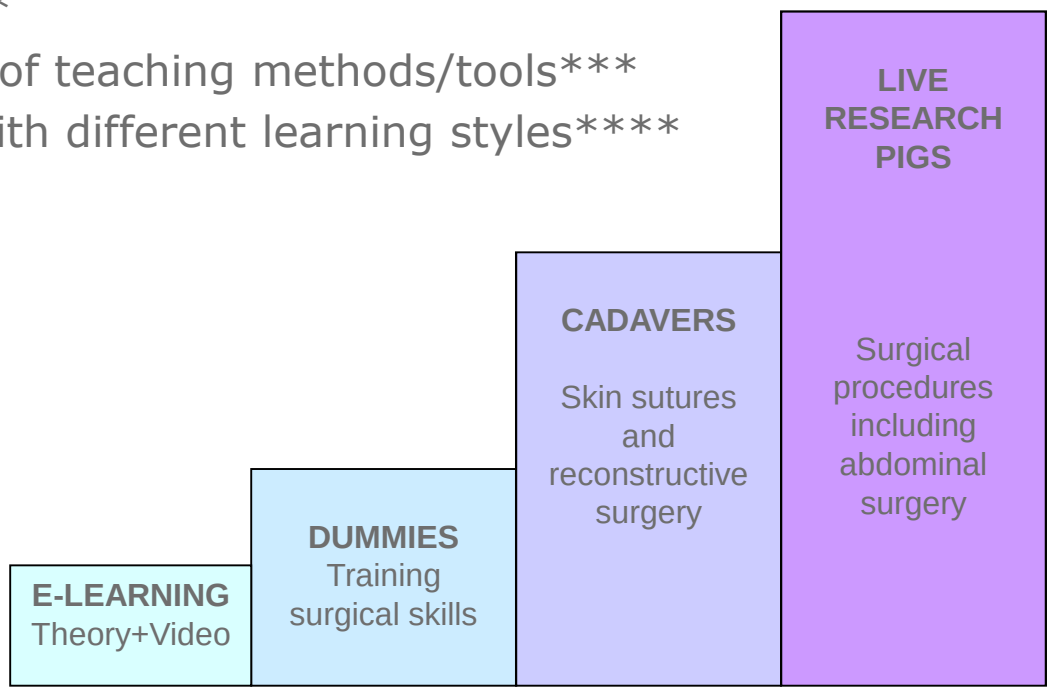
1 day theory (anaesthesia)

7 days practise

- Dummies
- Cadavers
- Live research pigs

The Basic Surgical Skills course

- Four steps
- Stepwise more challenging*
- Variation **
- A selection of teaching methods/tools***
- Complies with different learning styles****

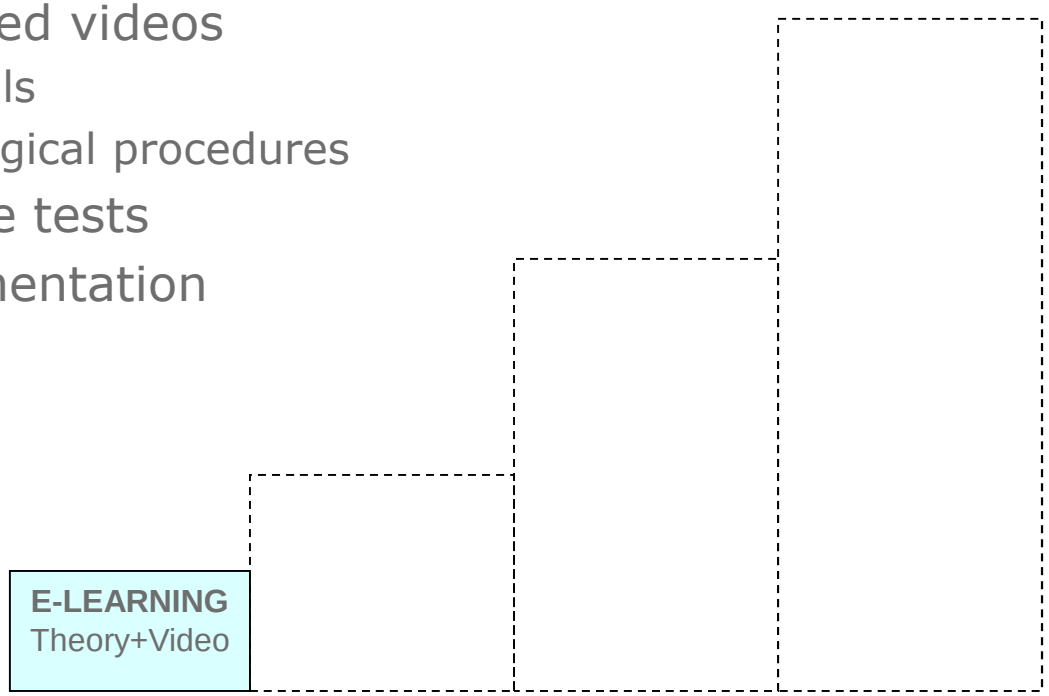


* Ericsson (2004); ** Dohn et al (2009)
*** Lauridsen & Lauridsen (2009), **** Dunn & Dunn (1999)

The Basic Surgical Skills course

Step 1. E-learning

- Narrated Power Point Presentations
- Narrated videos
  - Skills
  - Surgical procedures
- On-line tests
- Documentation

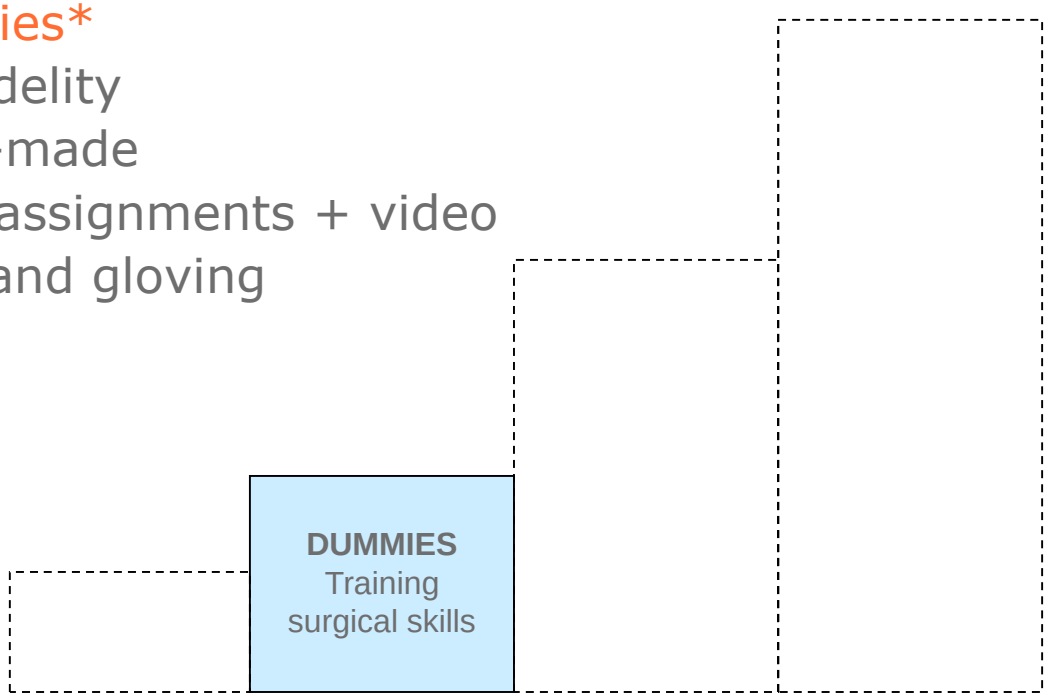


The Basic Surgical Skills course

Step 2. The Surgical Skills Laboratory

Two days
15 stations

- 12 Dummies*
  - Low-fidelity
  - Home-made
- 2 written assignments + video
- Gowning and gloving



* The term 'Dummy' is used as a collective word covering simulators, models, mannequins and other artificial substitues for live animals

The Basic Surgical Skills course

Step 2. The Surgical Skills Lab

36 students – rotate between stations

2 teachers – demonstrate, instruct and give feedback

No formal assessment of students' performance

The Basic Surgical Skills course

14. LAPAROTOMY

Make a midline incision in the abdominal wall without damaging viscera (without harming the balloon!)

Incise the skin and subcutane layer (Allevyn)

- Remember to use two fingers to strech the skin
- Don't lift the scalpel once you started incising
- Use pencil-grip for shorter incisions in small animals

Grab the linea alba/fascia (tenting) and make a stab incision

- Use one or two tissue forceps
- Do not let go of the hole once you've made it!

Extend the incision in both directions, using a guide (tissue-forceps/fingers/probe) and scalpel or scissors

2. PREPARATION OF THE PATIENT

Prepare the patient for surgery. This patient has a small benign skin tumor that has to be removed.

Palpate the tumor and draw the planned incision lines (use red pencil).

- Remember to consider tension-lines!
- Remember to consider margins!

Outdraw the area that needs to be clipped (blue pencil). At the minimum 10 cm on each side of the incision!

Disinfect the surgical field – remember to wear gloves, using:

- Hibicet
- Alcohol

Drape and fix the draping – use Foliodrape. Remember that the hole in the draping needs to be a little larger, when using Foliodrape

The Surgical Skills Laboratory

Station no.1. Intravenous catheterisation

Materials

- Toy dog with artificial Vena cephalica (silicone tube) covered by 'skin' (nylon stocking). Vessel supplied with artificial blood by infusion

The Surgical Skills Laboratory

Station no.2. Preparation and draping + incision lines

Materials

- Toy dog with a 'skin tumor' (wooden bead placed on inside of 'skin') placed on lateral side of thorax and covered with clear plastic. A green and a red pen plus disinfectants, draping and tape

The Surgical Skills Laboratory

Station no.3. Preparation of surgeon

Materials

- Caps, sterile gowns, gloves and sponges

The Surgical Skills Laboratory

Station no.4. Behaviour in the Operating Room

Materials

- Video – OR situations
- Written assignment
  - 'Find 5'

The Surgical Skills Laboratory

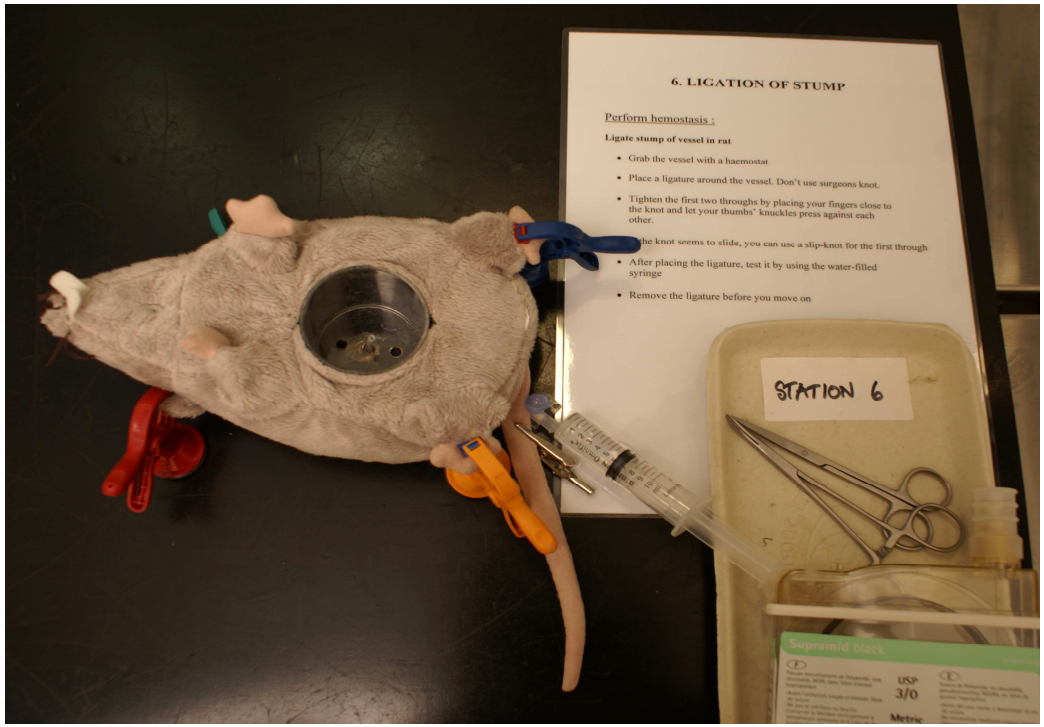
Station no.5. Hand ties

Materials

- Toy rat/bat. Blue and green string supplied through holes in the 'body'

The Surgical Skills Laboratory

Station no.6. Ligation of stump



Materials

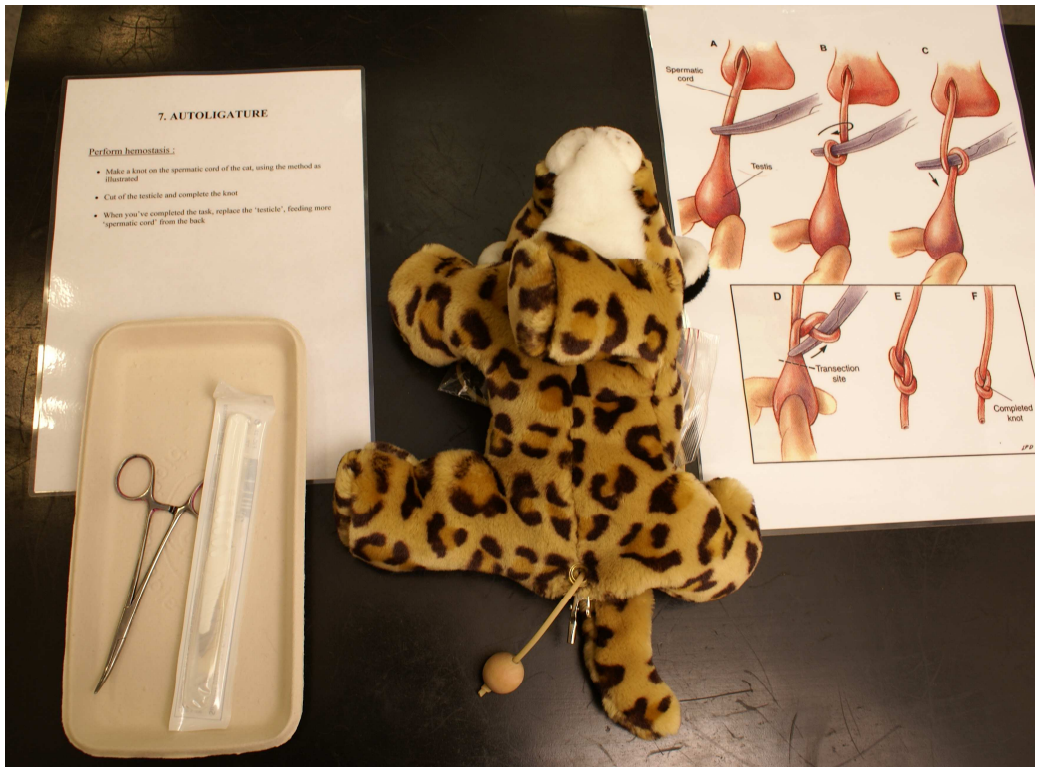
- Toy rat with a (silicone) stump of 'vessel' is placed deep inside a narrow abdomen. A water-filled syringe is connected to the opposite end of the tube

The Surgical Skills Laboratory

Station no.7. Autoligature (Orchiectomy, cat)

Materials

- Toy cat with a spermatic cord (rubber tube) and testicle (wooden bead) placed under tail

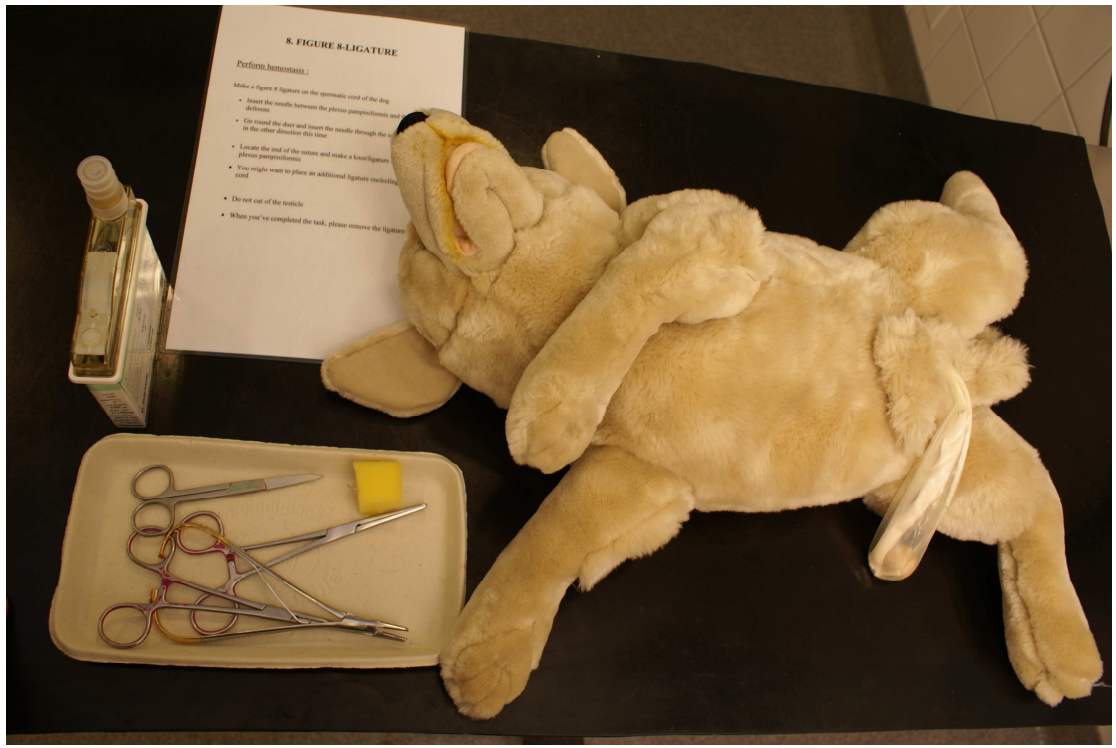


The Surgical Skills Laboratory

Station no.8. Fig.-8 ligature (Orchiectomy, dog)

Materials

- Toy dog with a Tunica vaginalis (condom), plexus pampiniformis (balloon with corn flour) and a ductus deferens (silicone tube) placed in 'prescrotal' area

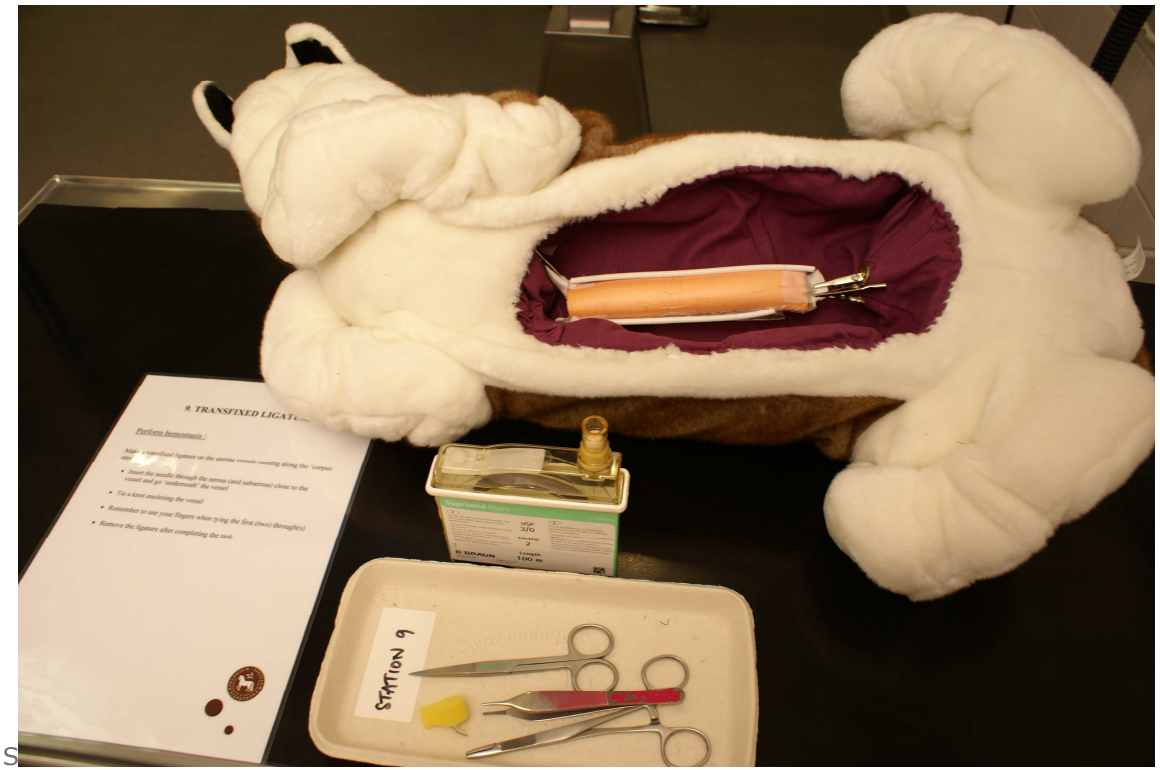


The Surgical Skills Laboratory

Station no.9. Transfixed ligature ('Uterus', dog)

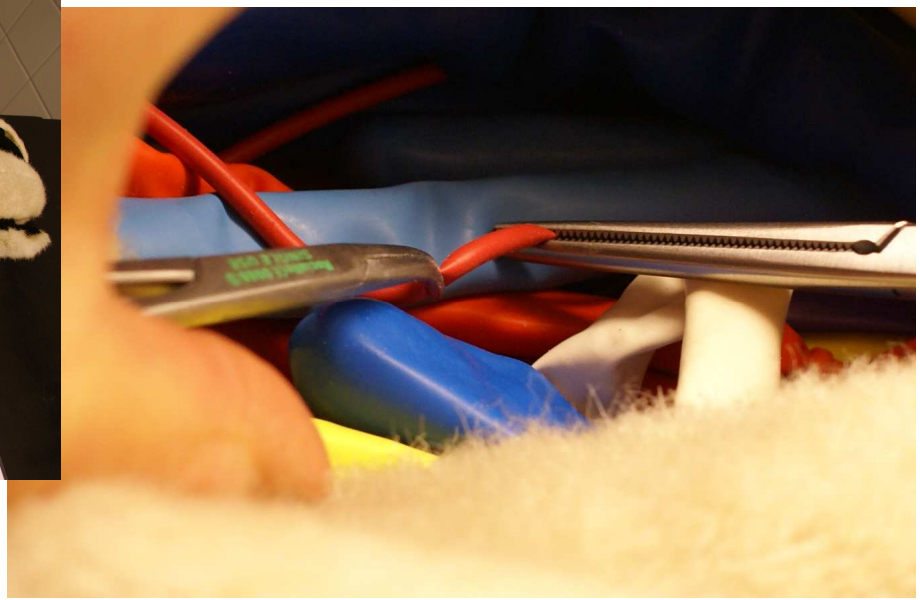
Materials

- Toy dog with a uterus (polyurethane) and uterine vessels (silicone tubes) placed in abdomen



The Surgical Skills Laboratory

Station no.10. Double ligature in abdomen



Materials

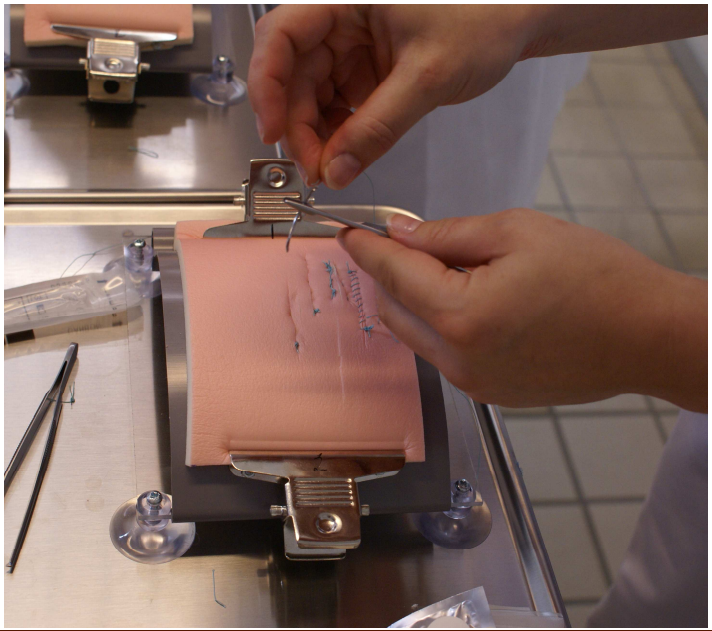
- Toy dog with two large vessels placed deep inside the abdomen which is packed with 'viscera' (flour-filled and water-filled balloons)

The Surgical Skills Laboratory

Station no.11. Knotting and suturing technique

Materials

- Polyurethane fixed in holdersSutures, instruments and instructional drawings



The Surgical Skills Laboratory

Station no.12. Instruments and sutures

Materials

- Numbered instruments. Suture packages for illustration
- Written assignment

The Surgical Skills Laboratory

Station no.13. Drainage

Materials

- Toy dog with abcess (double layered latex plus mayonnaise) placed on the shoulder

The Surgical Skills Laboratory

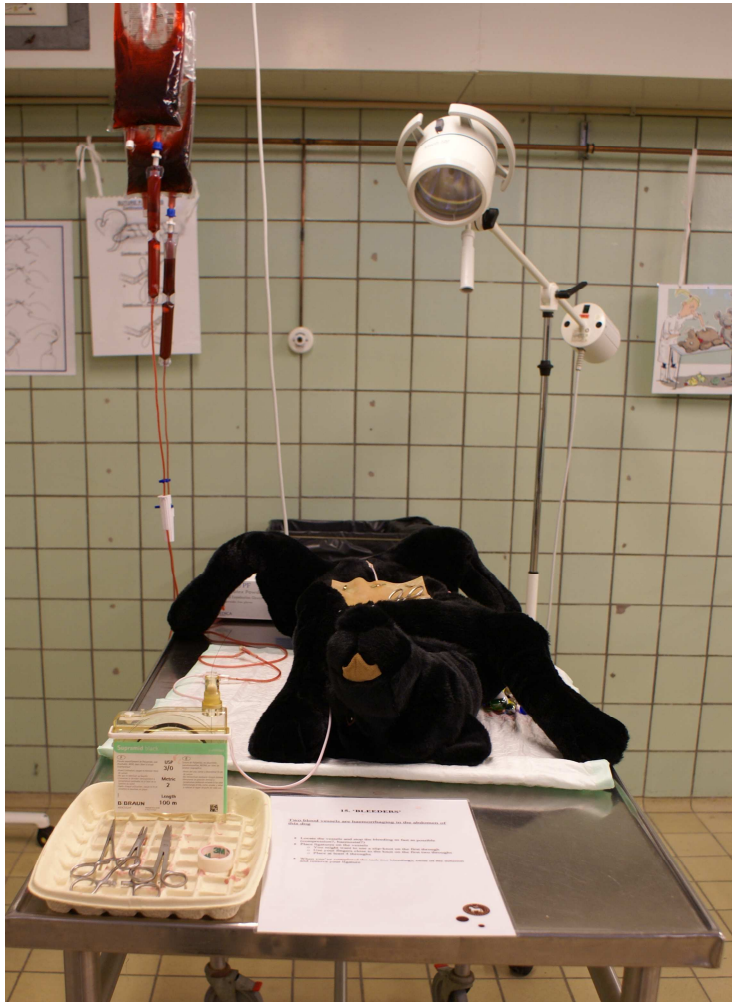
Station no.14. Laparotomy

Materials

- Toy dog with an air-filled balloon placed in the abdomen and covered by 'skin', 'sub-c' and 'fascia' (polyurethane and latex)

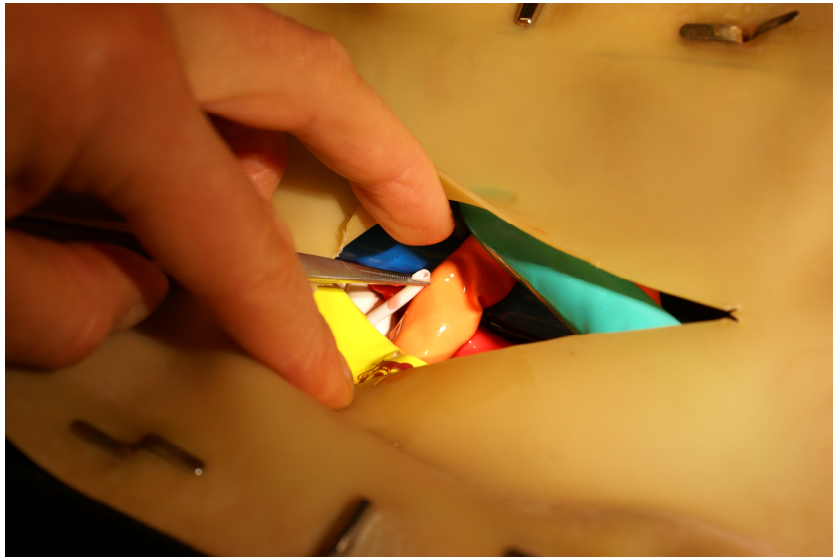
The Surgical Skills Laboratory

Station no.15. Bleeders



Materials

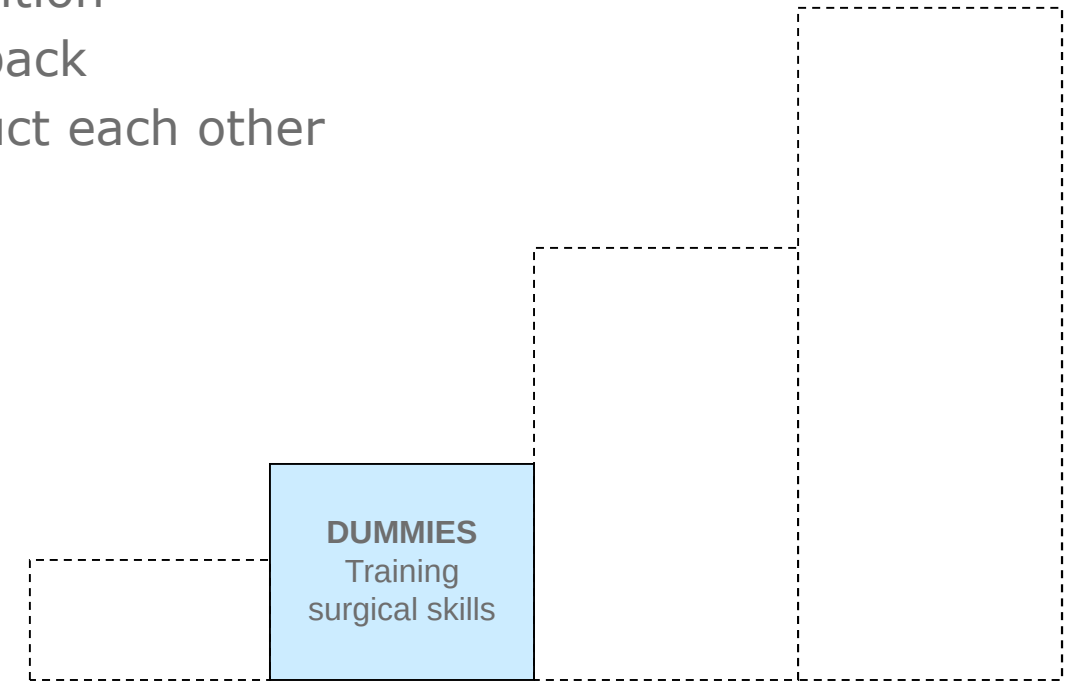
- Toy dog with two vessels (silicone) placed in a 'skin'(latex)-covered abdomen. Vessels are supplied with 'blood' by infusion. Abdomen is filled with viscera (flour filled balloons)



The Surgical Skills Laboratory

From a Learning point of view

- Try out, practise
- Repetition
- Feedback
- Instruct each other
- SAFE



The Surgical Skills Laboratory

It’s practical, but …

Does it work?

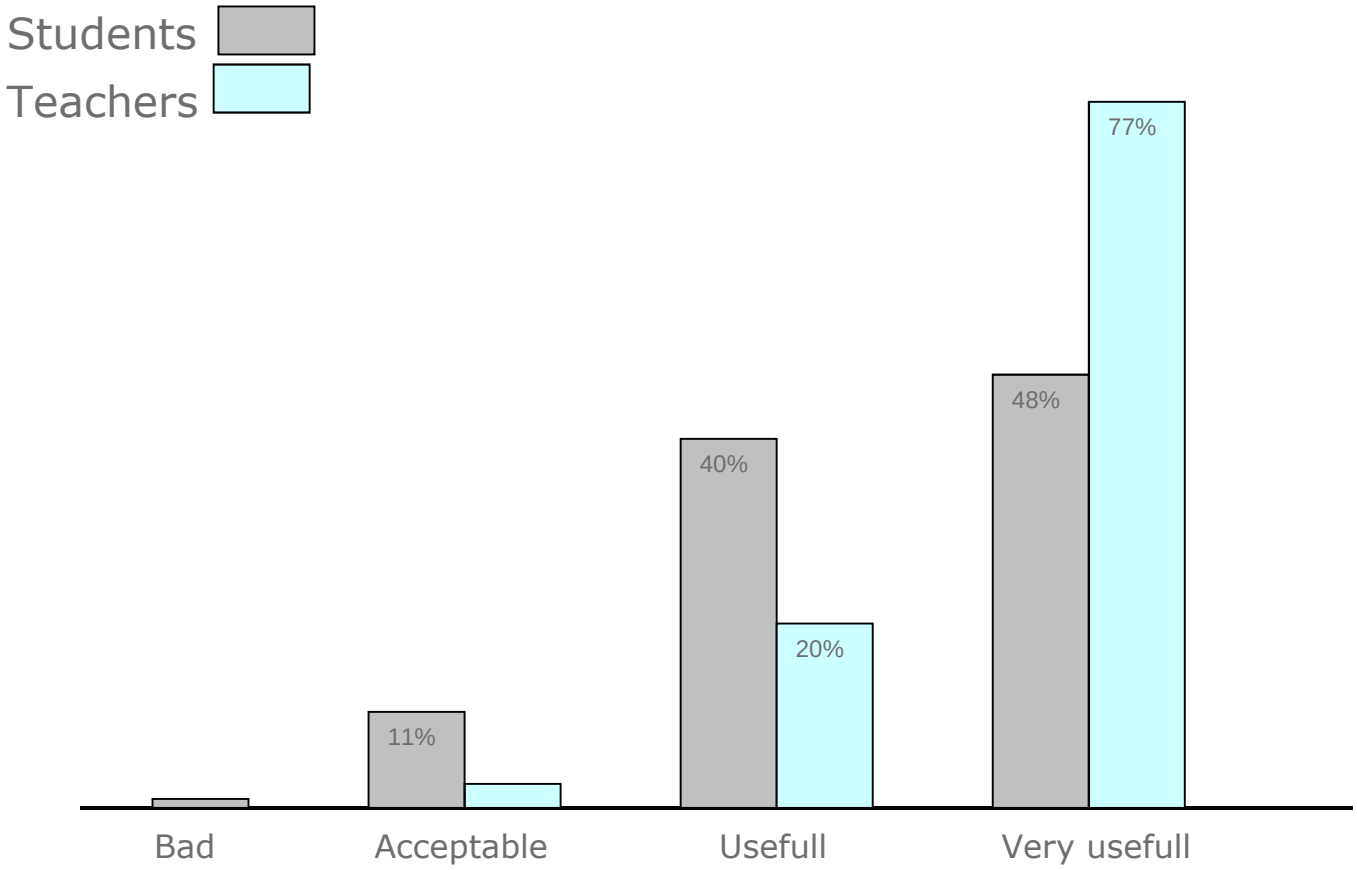
Evaluation of Dummies

146 students and 4 teachers evaluated on a 4-point Linkert scale

'Evaluate the usefulness of the dummy for training the individual procedures'.

(1=Bad, 2=Acceptable, 3=Useful, 4=Very useful).

Evaluation of Dummies - Results



Evaluation of the usefullness of dummies for practising individual skills (sum.)
Based on evaluations (4-point Linkert scale) from 146 students and 4 teachers

Evaluation of learning experience

Interview study

- 26 veterinary students attending the Basic Surgical Skills course
- Semi-structured interviews
- 20-30 min
- Conducted immidiately after step 4 (live animal surgery)

Interview guide

Research questions	Interview questions
•As an educational tool, how do veterinary students assess the models in the Surgical Skills Lab? •How does participating in the Surgical Skills Lab influence the level of anxiety prior to students' first live-animal surgical experience? •During the Basic Surgical Skills course, which elements in particular seem to be motivating to the students?	Tell me about your experiences in the Surgical Skills Lab Tell me about your experiences with live animal surgery on the pigs Tell me what you gained from training on the dummies – if anything? Please elaborate… You mentioned that the atmosphere in the SSL/OR was (.....) What does that mean to you when you're in a learning situation?

Interviews - Results

Subjects mentioned in relation to training on dummies:

- Procedural subjects
  - Tactile
  - Dimensional
  - Visual
  - Situational
- Emotional subjects
  - Feeling more secure/less anxious (at prospect of OR)
  - A safe atmosphere in SSL (enhances focus and learning)

Emotions in Veterinary Surgical students

Triangulated study – focusing on anxiety

- Interviews
- Questionnaires (STAI and PAQ)
- Survey (Emotions experienced)
- Heart Rate monitoring

Comparative study

- Basic Surgical Skills course
- Non-surgical course

Parallel group study

- Study group
  - Attended all steps in the Basic Surgical Skills course
- Control group
  - Did not attend step 2 – the Surgical Skills Laboratory

Anxiety was measured in relation to students' first live animal surgical experience

Anxiety in Veterinary Surgical students

Results

- Veterinary surgical students are anxious before live animal surgery
- **Participating in the Surgical Skills Lab reduces anxiety before live animal surgery**

Anxiety and learning

Learning theories and scientific studies:

Anxiety is detrimental to learning and to developing skills*

*Illeris (2006); Illeris(2004);Beylefield & Struwig(2007); CERI (2007); Dohn et al (2009); Eysenck (1979); Fredrickson (2005); Gläser-Zikuda et al (2005); Isen et al (1985); Isen et al (1991); Isen (2001); Konradt & Hoffmann (2003); Reschly et al (2008); Sappington (1984); Evans & Gerlach (2007); Gade (1997); Sylwester (1994)

The Surgical Skills Laboratory

Pedagogical bonus?

Training on lo-fidelity Dummies

- Technical preparation
- **Mental preparation**

Anxiety-reducing effect enhances learning of skills

The question of fidelity

Interview-findings

- No request for high-fidelity
- 'For this purpose'
- Simple skills
- Problem of assessment
- Transfer?

Litterature

- Low-fidelity as good as high-fidelity*
- Simple skills
- Problem of assessment

*Kneebone (2005); Bradley (1999); Davoudi et al (2010); De Giovanni et al (2009);Grober et al (2004); Matsumoto et al (2002)

The question of fidelity

Low-fidelity

Advantages

- Practical
  - Low cost
  - Multiple uses
- Pedagogical
  - No information overload/'too overwhelming'
  - Focus on the skill
  - ? Avoid an eeriness effect (the 'uncanny valley')*

Disadvantages

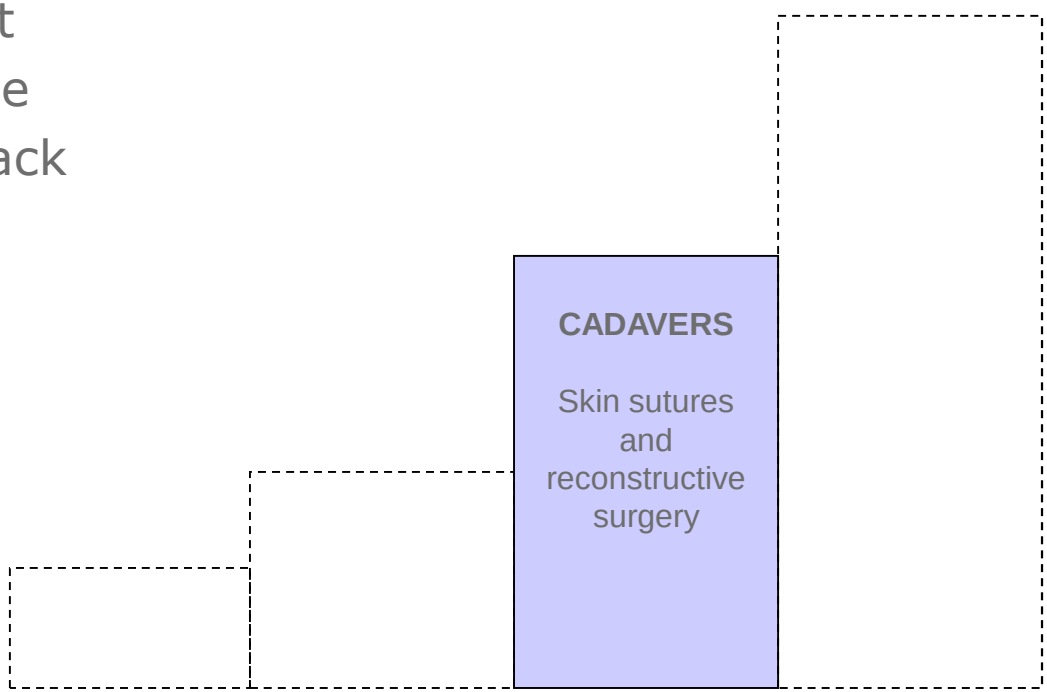
- Too big a gap/Transfer difficulties?
- Not suitable for entire procedures?
- Simple >< complex skills
- Not suitable as live animal substitute?

*MacDormand & Ishiguro (2006); Mori (1970); Seyama & Nagayama (2007)

Basic Surgical Skills course

Step 3. Cadaver Lab

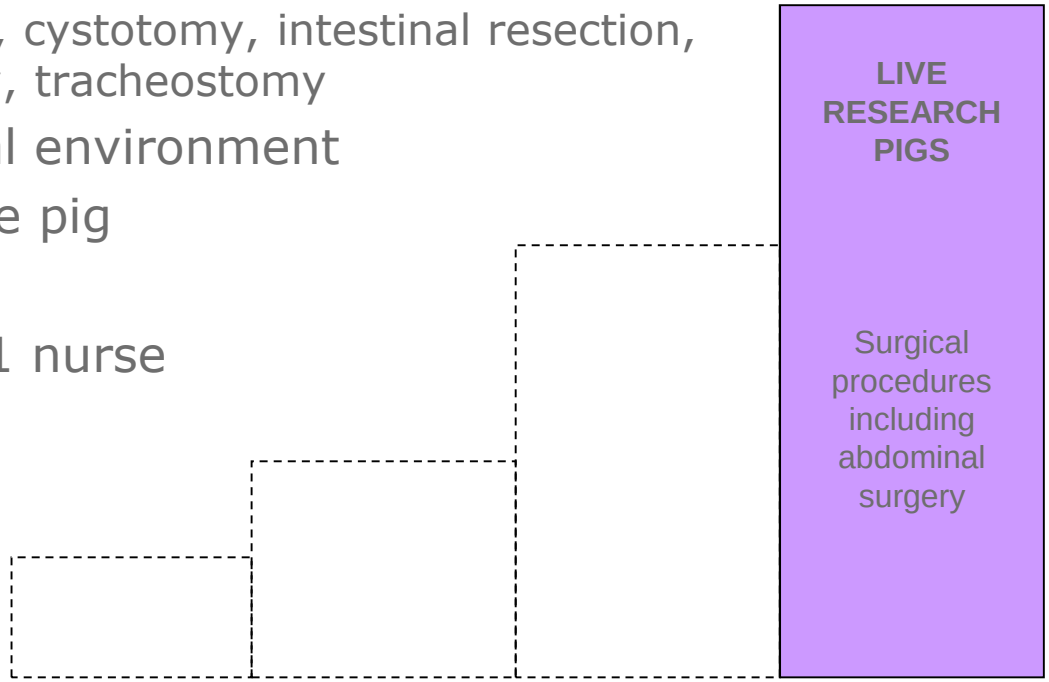
- One day
- Try out
- Practise
- Feedback
- SAFE



Basic Surgical Skills course

Step 4. Live research pigs

- Four days
- Entire surgical procedures
  - Gastrotomy, cystotomy, intestinal resection, orchiectomy, tracheostomy
- Proper surgical environment
- 4 students/one pig
- 9 pigs
- 2 teachers + 1 nurse
- Terminal lab



'Transfer' example 1

Laparotomy

'Transfer' example 2

Orchiectomy

Step 4. Live Research Pigs

Evaluation – Teachers overall impression

- Lower level of stress/anxiety
- Relatively relaxed atmosphere
- Students finish on time
- Satisfactory performance
- Good contact with students
- Enthusiasm throughout

No formal assessment of students' performance

The Basic Surgical Skills course

Student's comment:

"I think it was an amazing course, and because of the Skills Lab, we were able to gain so much more from the surgical practise on the reaserch pigs."

Creating a Dummy

Considerations

- What is the difficult part of a particular skill?
- Consider the issues
  - Tactile
  - Dimensional
  - Visual
  - Situational
- What do we want to teach?
  - Simple/basic skills (when is a skill 'simple'?)
  - Surgical procedures
- Hi- or low-fidelity
  - What is necessary for this particular skill?
- Multiple or single use?
- Supplement or substitute for live animals?
- Cost…
- How do we assess?